



# Effects of Trap-related Emissions on Air Quality

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California Environmental Protection Agency



**Air Resources Board**

## Presentation Overview

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- Changes in Exhaust Emissions/Composition
- Models Used for Estimating Air Quality Impacts
- Air Quality Impacts
- Conclusions/ Next Steps

## Changes in Exhaust Composition

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- Assumed all On-road and most Off-road Diesels trap-equipped
- Total mass of NO<sub>x</sub> emissions unchanged
- Changes in NO<sub>x</sub> speciation
  - without trap 88% NO, 10% NO<sub>2</sub>, 2% HONO
  - with trap 48% NO, 50% NO<sub>2</sub>, 2% HONO
- Sensitivity study of hydrocarbons and aldehydes (set to zero)

## Models Used for Estimating Impacts

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- Photochemical Ozone Model
  - Latest chemistry
  - Validated based on recent ambient monitoring
  - Will be used for future clean air plans
- Predicts summer concentrations of
  - Ozone
  - NO<sub>2</sub>
  - nitric acid
  - nitric acid-derived PM

# Emissions in Southern California

(Tons/Day in 2010)

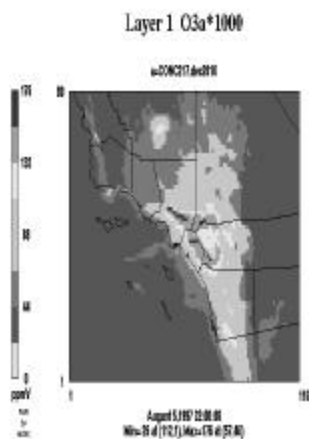
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# Ozone

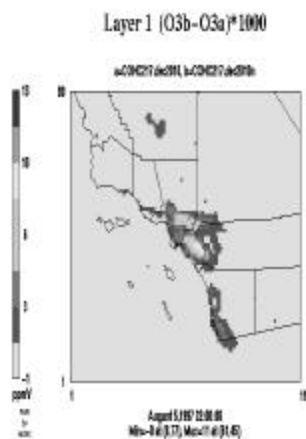
(Peak hour)

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**Base Case**

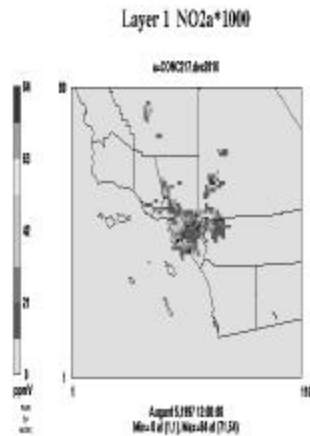


**Change w/ Traps**

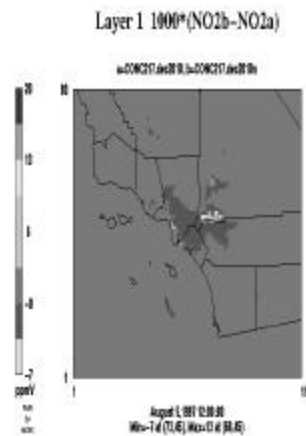


# Nitrogen Dioxide (Peak hour)

**Base Case**

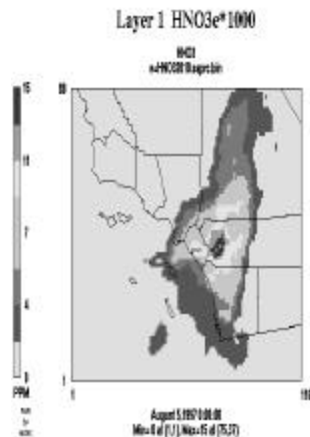


**Change w/Traps**

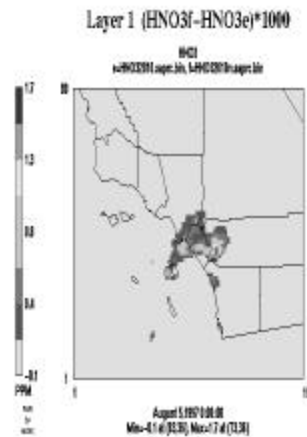


# Nitric Acid (24 Hour Average)

**Base Case**



**Change w/Traps**



## Summary of Impacts

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- Ozone
  - 4-7% increase in high ozone areas (11 ppb max.)
  - State ambient standard is 90 ppb
- Nitrogen Dioxide
  - 22% increase in one small area
  - ~5% in other areas
  - Remains below health-based ambient standard

## Sensitivity to Hydrocarbon Assumptions

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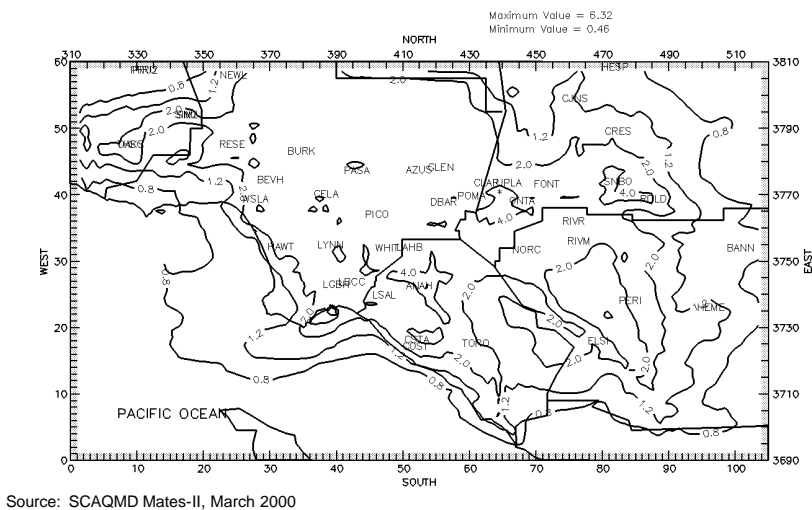
- Aldehydes
  - Assumed diesel aldehyde emissions = zero
  - Reduces peak ozone increase from 11 to 9 ppb
- Non-methane hydrocarbons
  - Assumed diesel NMHC emissions = zero
  - Reduced peak ozone increase from 11 to 6

## Summary of Impacts (continued)

- Nitric acid (24 hour)
  - 6-12% increase (1.7 ppb)
  - Linked to reduced child lung development
- Nitric acid-derived PM (24 hour)
  - 5.5  $\mu\text{g}/\text{m}^3$  increase (compared to 50  $\mu\text{g}/\text{m}^3$  air quality standard)

## Directly Emitted Diesel PM

(Modeled Annual Average)



## Uncertainties

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- Diesel Exhaust Composition Not Well Known
  - aldehydes (limited data)
  - HONO (no data)
- Possible Increase in Nitro PAH Not Evaluated
  - PAH emissions data not yet analyzed
  - Photochemical model needs revision

## Conclusion

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- Passive traps increase NO<sub>2</sub> emissions significantly
- Increased NO<sub>2</sub> emissions result in
  - Increased summer peak ozone (4-7%)
    - HC reductions cut increase by half
  - Increased summer NO<sub>2</sub> (but below standard)
  - Increased summer nitric acid (6-12%)
  - Increased summer nitric acid-derived PM (~10% of allowable ambient PM standard)
    - Reduced elemental carbon emissions may offset

## Next Steps

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- Apply aerosol model to predict daily PM effects, both summer and winter
- Revise chemistry to evaluate Nitro PAH
- Apply annual model to predict Nitric Acid/PM annual average effects
- Improve emission estimates